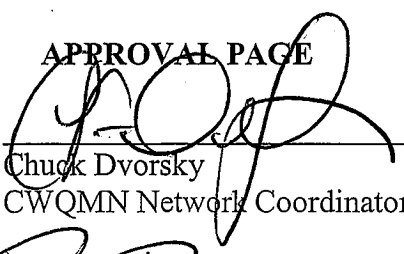


TEXAS COMMISSION ON ENVIRONMENTAL QUALITY/CITY OF
WACO
LAKE WACO HEADWATER
CONTINUOUS WATER QUALITY MONITORING
PROJECT PLAN

A1 APPROVAL PAGE



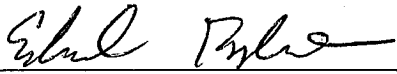
Chuck Dvorsky
CWQMN Network Coordinator, TCEQ

5-17-07
Date




Patrick Roques
Section Manager, TCEQ WQM&A Program

5/18/07
Date



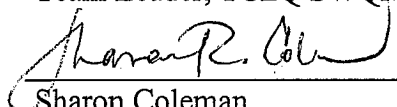
Edward Ragsdale
TCEQ SWQM Project Lead & CWQMN Quality Control Officer

5/17/07
Date



Brenda Archer
Team Leader, TCEQ SWQM Program

5/18/07
Date



Sharon Coleman
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Date

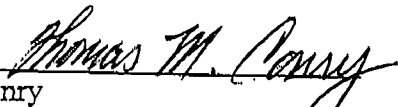


Frank Burleson
Manager Water Program, TCEQ Region 9

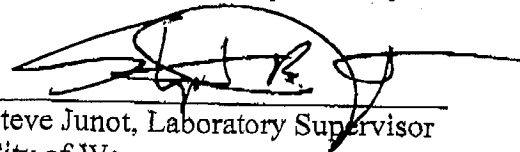
5/21/07
Date

Texas Commission on Environmental Quality
Continuous Water Quality Monitoring Network Quality Assurance Project Plan

Appendix R


Tom Conry
Program Manager, City of Waco

5/22/07
Date


Steve Junot, Laboratory Supervisor
City of Waco

05/22/07
Date

This TCEQ/City of Waco Project Plan documents specific details for a new continuous water quality monitoring project not covered in the Continuous Water Quality Monitoring Network (CWQMN) Quality Assurance Project Plan (QAPP). Please see the CWQMN QAPP for other network details.

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Figure 1: A4.1 Project Organizational Chart

LIST OF ACRONYMS

CAMS	Continuous Ambient Monitoring Station
CFS	Cubic Feet per Second
CVS	Calibration Verification Sample
CWQMN	Continuous Water Quality Monitoring Network
DO	Dissolved Oxygen
DM&QA	Data Management and Quality Assurance
DQO	Data Quality Objective
EC	Electrical Conductance (Reported as Specific Conductance)
FOD	Field Operation Division
IB	Instrument Blank
LCS	Laboratory Control Sample
MDL	Method Detection Limit
mg/L	Milligram per Liter
LEADS	Leading Environmental Analysis and Display System
MOPs	Monitoring Operation Division
MQO	Measurement Quality Objective
NA	Not Applicable
NIST	National Institute of Standards and Technology
PO₄-P	Orthophosphate-phosphorus
PMA	Preventative Maintenance Code
ppmv	parts per million by volume
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SC	Specific Conductance
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring Team
T	Temperature
TP	Total Phosphorus
TIAER	Texas Institute for Applied Environmental Research
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
RPE	Relative Percent Error
SC	Specific conductance
SWQM	Surface Water Quality Monitoring Team
TRP	Total Reactive Phosphorus
USGS	United States Geological Survey
µS/cm	micro siemens per centimeter
WQM&A	Water Quality Monitoring & Assessment Section
°C	Degrees Centigrade

A3 DISTRIBUTION LIST

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Ms. Chris Owen, Quality Assurance & Audit Team, Data Management & Quality Assurance Section,
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Texas Water Science Center

8027 Exchange Drive

Austin, Texas

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GREENSPAN ANALYTICAL

1195 Airport Road

Lakewood, New Jersey 08701

Mr. Jason Harrington, Manager Greenspan Analytical, (512) 217-5591

A4 PROJECT/TASK ORGANIZATION

This section is intended to identify individuals and organizations that will be responsible for developing and/or supporting new CWQMN projects. For a list of additional project/task and responsibilities please refer to section A4 of the CWQMN QAPP.

A4.1 TCEQ Network Coordinator (Charles Dvorsky)

- Amend TCEQ/USGS contract to include Valley Mills flow station up-grade.
- Provides overall support for coordination, development, and installation of new Continuous Ambient Monitoring Station (CAMS).

A4.2 City of Waco Program Manager (Tom Conry)

- City of Waco project contact.
- Responsible for obtaining, managing, and analyzing project data.
- General oversight of activities pertaining to City of Waco responsibilities.

A4.3 City of Waco Laboratory Manager (Steve Junot)

- Direct supervision of scheduling and activities for selected Waco field staff.
- Troubleshoot basic analytical issues following discussion with field staff.
- Secondary response for field operations.

A4.4 TCEQ Project Lead and CWQMN QC Officer (Edward Ragsdale)

- Responsible for writing Project Plan jointly with City of Waco.
- Responsible for site development.
- Coordinate testing of Aqualab analyzer Total Phosphorus (TP) Laboratory Control Sample (LCS) and Instrument Blank (IB) up-grades.
- Lead for writing initial draft Aqualab TP analytical SOP.
- Responsible for coordinating initial training for new site operators.
- Responsible for purchasing Aqualab TP analyzer common spare parts.
- Responsible for implementing Aqualab maintenance contract after year warranty expires.
- Participate in station deployment.

A4.5 City of Waco (Sally French)

- Lead for station operation and maintenance.
- Lead for training per TCEQ protocols - calibration/operation/maintenance
- Participate in station deployment.
- Oversight of secondary field staff (Sarah Epperson and/or Jennifer McDonald)

A4.6 TCEQ Waco Office (Wilson Snyder)

- Responsible for obtaining quotes for site infrastructure and ensuring work is completed.
- Landowner liaison.

A4.7 TCEQ Data Validation (Rebecca Ross)

- Aqualab Analyzer and sonde data validation.

A4.8 TCEQ Stephenville (Chris Pearson)

- Responsible for on-site CAMS training for City of Waco and Waco TCEQ staff.
- Assist in initial training session for new site operators.

A4.9 TIAER Laboratory Manager (Mark Murphy)

- Provides Aqualab TP analyzer standards and reagents.

A4.10 United States Geological Survey (Michael Dorset)

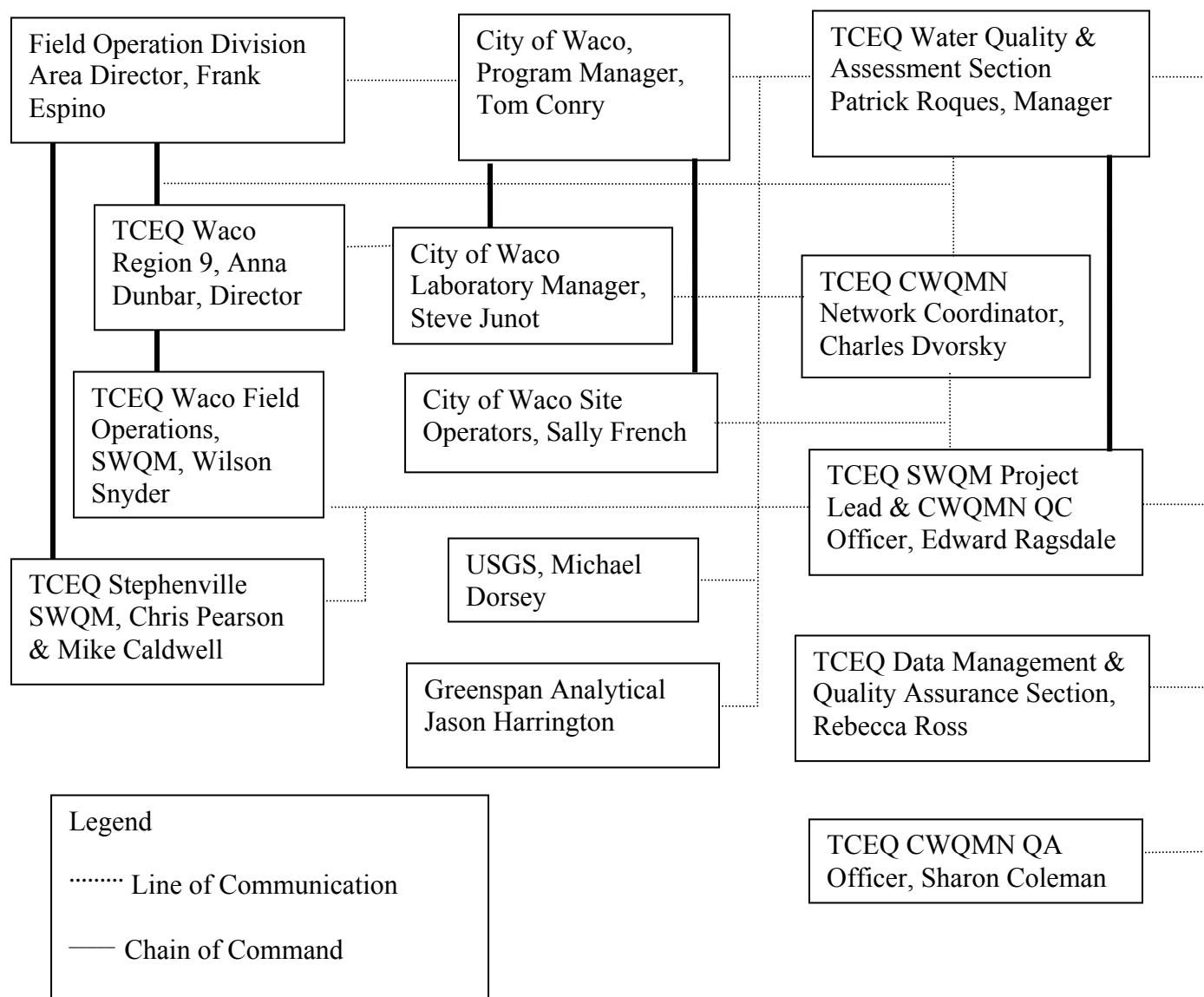
- Upgrade Valley Mills flow monitoring stage to full-range.
- Maintain Valley Mills flow monitoring station.

A4.11 Greenspan Analytical (Jason Harrington)

- Responsible for providing/coordinating Aqualab TP analyzer repair visits.
- Once purchased by TCEQ, responsible for the coordination of Aqualab TP analyzer IB and LCS capability up-grades.
- Responsible for developing Aqualab TP analyzer parts list and ensure parts are available for TCEQ purchase.
- Responsible for coordinating the development of maintenance procedures for Aqualab TP analyzer.

PROJECT ORGANIZATION CHART

Figure A4.1 Organization Chart



A5 PROBLEM DEFINITION/BACKGROUND

Lake Waco provides drinking water for many people in the City of Waco and vicinity. High nutrient concentrations sometimes cause excessive growth of algae and other aquatic plants in water bodies that can lead to taste and odor problems in drinking water sources, even after treatment.

Representatives from Texas Commission on Environmental Quality (TCEQ) and City of Waco met on December 21, 2006 to discuss preliminary projects objectives and details. An additional meeting between TCEQ and City of Waco staff was conducted on February 27, 2007 to discuss project equipment options and other project details for the joint development of this project plan.

The City of Waco is concerned that storm water pulses from the North Bosque River watershed are responsible for taste and odor problems with the Lake's drinking water. Consequently, it was decided that a continuous water quality monitoring site be installed near Lake Waco headwaters that would provide needed characterization of phosphorus inputs to the lake as well as providing other water quality information.

TCEQ's project objective is to provide continuous water quality and flow data to the City of Waco. It was agreed to by the parties that the project would consist of one Continuous Ambient Monitoring Station (CAMS). The CAMS will be located on the North Bosque River (Segment 1226) on the Talbert Ranch just downstream of Coopers Crossing. The CAMS location is approximately 8 river miles upstream of Lake Waco's conservation pool level. The length of the project will be five or more years.

A6 PROJECT/TASK DESCRIPTION

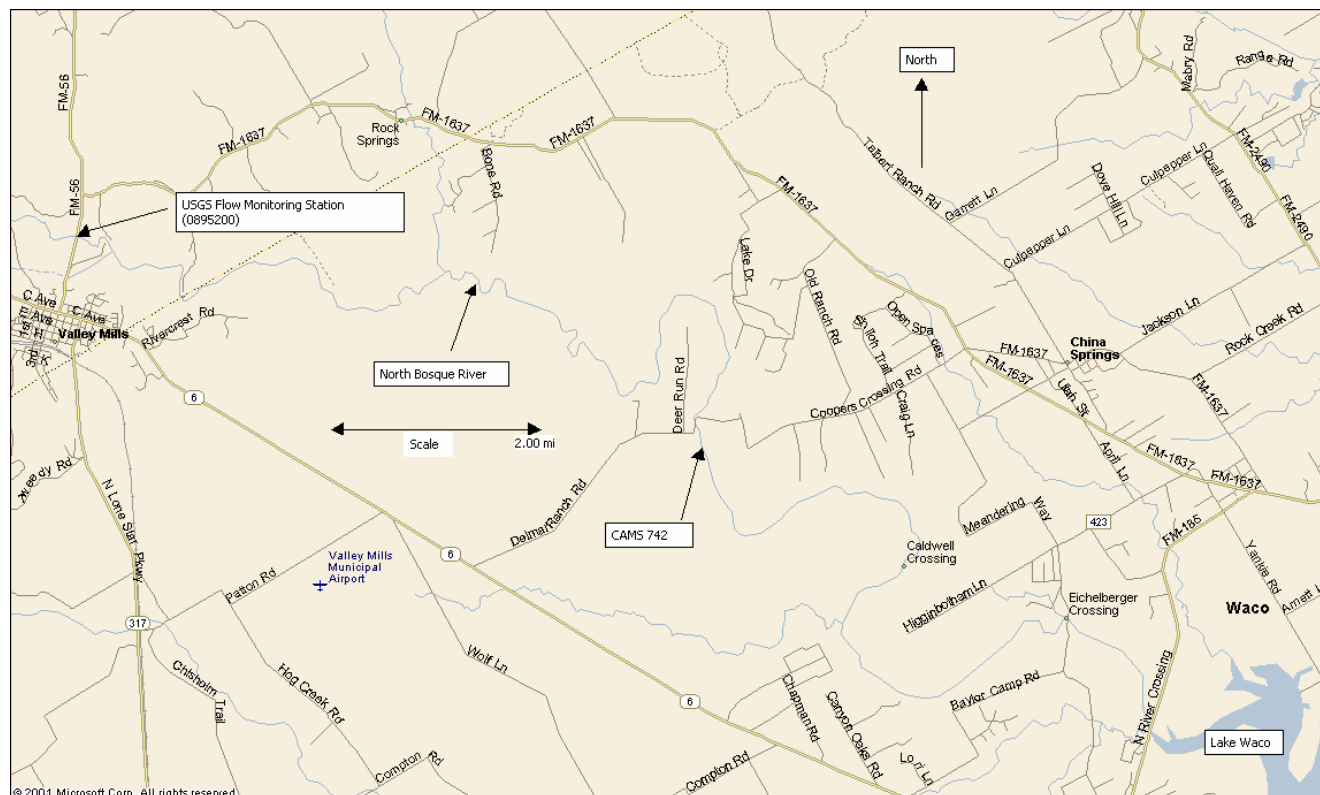
TCEQ will install a CAMS (number 0742) on the North Bosque River near the headwaters of Lake Waco. CAMS measurement equipment will include an Aqualab Total Phosphorus (TP) analyzer, Greenspan sonde multi-probe, and water level sensor. The Aqualab Analyzer will measure TP and Total Reactive Phosphorus (TRP). The sonde will measure Dissolved Oxygen (DO), Specific Conductance (SC), pH, and temperature.

TCEQ will contract with United States Geological Survey (USGS) to up-grade an existing USGS flow monitoring station at Valley Mills, Texas, to a full-range station. An existing TCEQ/USGS contract will be amended to include flow monitoring station up-grade.

Water quality, flow, and water level data will be available via the internet.

Work products discussed in this Project Plan are; CAMS site development, USGS contract amendment, CAMS installation, Standard Operating Procedure (SOP) development, site operator training, and procurement of various spare parts and Aqualab analyzer up-grades.

Figure1: Map of Monitoring Locations



CAMS 742, Latitude: 31.637263985°, Longitude: -97.366661853°

A7 QUALITY OBJECTIVES AND CRITERIA

Methods used for the Aqualab TP Analyzer and Greenspan CS4-1200 are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998 unless otherwise noted.

Aqualab Total Phosphorus Analyzer

Aqualab TP analyzer has undergone initial testing by TCEQ. This particular Aqualab analyzer has not been deployed in the field by TCEQ. However, it is anticipated that Aqualab TRP analyses will routinely meet criteria listed in table A7.1 based on TRP Quality Control (QC) results from Aqualab analyzers (29U) currently deployed on the Bosque and Leon Rivers. TCEQ test data suggest that TP performance specifications will be comparable to the performance specifications of the TRP analysis. Table A7.1 represents initial Aqualab TP analyzer performance criteria for this project. When sufficient QC sample results become available, QC criteria may be adjusted accordingly. Please see Section B5 for more details.

Table A7.1 – Initial Greenspan Aqualab TP Analyzer Measurement Quality Objectives

Parameter	Parameter Code	Units	Method	MDL	AWRL	Blanks	Recovery at AWRL (LCS)	Precision (Relative Percent Difference)
TRP (0-0.600 ppmv Range)	10105	ppmv	Colorimetric, Standard Method 4500-P E	0.003*	0.040	≤ 0.006*	75 – 125%*	≤ 20.0%*
TP (0-0.600 ppmv Range)	1007	ppmv	Persulfate Oxidation, 4500-P.B.	0.003*	0.060	≤ 0.006*	75 – 125%**	≤ 20.0%*

* Initial performance specifications.

** Initial performance specification. The total P analysis includes the added step of persulfate digestion. After sample digestion to reactive phosphorus the TP sample is then analyzed using Standard Method 4500-P E.

MDL = Method Detection Limit

AWRL = Ambient Water Reporting Limit

LCS = Laboratory Control Sample

ppmv = parts per million by volume

RPD = Relative Percent Difference

TP = Total Phosphorus

TRP = Total Reactive phosphorus

NA = Not Applicable

Table A7.2 - Greenspan CS4-1200 Sonde (Multi-Probe) Data Quality Objectives

Parameter	Parameter Code	Units	Method	Calibration Verification Sample (CVS) **
pH	00400	pH / unit	Glass electrode, Standard Method 4500-H+B	±0.50 pH unit
DO	00300	mg/L	Galvanic membrane electrode, Standard Method 4500-O-G	% Saturation ≤6.0% ±0.50 mg/L
SC	00094	µS/cm	Toroidal*	≤5.0% RPE
Temperature	00010	°C	Standard Method 2550 B	NA

*Method not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998

** CVS criteria for use in the 305(b) and 303(d) Lists per SWQM DQOs.

NA = Not Applicable

USGS Flow Monitoring and Station at Valley Mills

TCEQ will contract with USGS to up-grade an existing (USGS Number 08095200) high-range flow monitoring station located at Valley Mills, Texas to a full-range flow monitoring station. The station's rating below 5,000 CFS will need re-development.

The USGS flow monitoring station is located approximately 11 river miles upstream of the proposed CAMS location. According to USGS, the total drainage area of the North Bosque River watershed is 1,146 square miles at Valley Mills and 1,196 square miles at Coopers Crossing, a difference of 4.4 percent.

Table A7.3 - USGS Full-Range Flow Monitoring Station Performance Specifications*

Range	Stage Accuracy	Discharge Accuracy
220,000 CFS/44.6 ft stage	± 0.03 feet	± 8.0%

*Specifications provided by USGS

Table A7.4 - In-Situ TROLL 500 Performance Specifications*

Range	Accuracy	Resolution
0 -11 meters	0.05 % Full Scale (-5 to 50 °C)	0.005 % Full Scale

* Specifications from TROLL 500 Operation Manual

Ambient Water Reporting Limits (AWRLs)

As described in sections A7 of the CWQMN QAPP.

Precision

Please see tables A7.1-2.

Bias

Please see tables A7.1-2.

Representativeness

As described in sections B2 of the CWQMN QAPP.

Comparability

As described in sections B2 of the CWQMN QAPP.

Completeness

As described in sections A7 of the CWQMN QAPP.

A8 SPECIAL TRAINING/CERTIFICATION

City of Waco will be the lead for site operation and maintenance.

Operation and maintenance of an Aqualab analyzer CAMS is complex, requires hands-on training and dedicated site operators. Additionally, site operators will need to be trained on sonde multi-probe and water level sensor calibration, operation, and maintenance.

Stephenville TCEQ staff will be responsible for the coordination and training of City of Waco staff. It is anticipated that site operator training could take up to six months. However, this time frame can be adjusted as needed.

Operator training will in part be accomplished by training sessions at an existing TCEQ CAMS located at Clifton, Texas. The Clifton CAMS employs an Aqualab analyzer that measures physiochemical water quality parameters as well as nutrients. The operation of this unit is very similar to the operation of the Aqualab TP Analyzer. A Greenspan CS4-1200 sonde will also be installed at the site for training purposes. An initial training event will be held by TCEQ staff at Clifton, Texas.

It is anticipated that the Lake Waco Headwaters CAMS will be installed and operational before operator training is completed. Consequently, additional training can be acquired by performing routine operation and maintenance (as well as trouble shooting activities) while the CAMS is in "PMA" (preventative maintenance code). "PMA" code operation flags data from the site so the data will not become part of the station's data record. Stephenville TCEQ staff will make the final determination when site operators are proficient enough to operate the site out of "PMA" code. Once training is complete the CAMS can be taken out of "PMA" code and the station's data record will begin.

A9 DOCUMENTS AND RECORDS

As described in sections A9 of the CWQMN QAPP.

B1 SAMPLING PROCESS DESIGN

Site Selection Criteria

The Talbert Ranch site near Cooper Crossing was chosen because it was the closest available site to the conservation pool level of Lake Waco. Mr. Talbert owns approximately one mile of North Bosque River frontage. As a result of site surveys and discussions with Mr. Talbert a site was chosen near the Ranch's northern property line. This location is not prone to flooding and is located on a steep bluff overlooking the river.

Monitoring Station Design

Monitoring and Support Equipment

USGS full-range flow and gage (water level) measurements will be made at Valley Mills, Texas.

The CAMS site will include the following monitoring and support equipment;

- Configured twelve-foot portable TCEQ water trailer.

- Aqualab TP analyzer, PVC sample line, submersible pump, submersible pump relay box, and sampling system support structure.
- Personal computer.
- Zeno data logger.
- Two US Robotics modems.
- Two Greenspan CS4-1200 sondes communication cables and support structure.
- In-Situ TROLL 500 Level Sensor, communications cables and support structure.

Monitoring Equipment Configurations and Measurement Frequencies

The Aqualab TP analyzer will be programmed to collect and analyze TRP and TP samples every six-hours.

Water quality measurements from the sonde and water level sensors will be logged once every 15-minutes by the data logger.

USGS flow and water level measurements made at Valley Mills will be continuous measurements.

Site Development

As mentioned previously, the monitoring location will be located near Talbert's Ranch northern property line. Delmar Ranch Road runs east and west at the northern property line. Site development needs are;

- Electrical service will need to be extended to the site. This will include the needed installation of several power poles and a 200 amp meter loop.
- A phone line will need to be installed to the site (connected to meter loop).
- A chain-link fence will need to be installed around the site to keep cattle away from site equipment. The fenced area needs to be large enough to include trailer and support equipment.
- In order to allow easy access to the site from Delmar Ranch Road an additional gate to the property will be installed near the northeastern property line. This additional access point will allow for minimal disruption to the landowner and his ranching activities.

B2 SAMPLING METHODS

As described in sections B2 of the CWQMN QAPP.

Sampling/Measurement System Corrective Action

As described in sections B2.2 of the CWQMN QAPP.

B3 SAMPLE HANDLING AND CUSTODY

As described in Section B3 of the CWQMN QAPP.

B4 ANALYTICAL METHODS

Analytical methods are listed in Section A.7.

B5 QUALITY CONTROL

As described in sections B5 of the CWQMN QAPP.

Please see Table A7.1-4 for QC criteria.

TP Analyzer and Digester

An Aqualab TP analyzer analytical SOP will be developed that details analyzer operation, QC procedures, and criteria.

TP and TRP Method Detection Limits were determined according to procedures in SOP AMPM-014 Section 9.1, *Analysis of Total Reactive Phosphorus in Ambient Surface Water Using an Aqualab Greenspan Auto-Analyzer*

Automated Instrument Blanks (IB) and Laboratory Control Sample (LCS) upgrades will be installed on TCEQ's existing TP analyzer. Once these upgrades are installed the analyzer will be able to automatically analyze IBs and LCSs on a daily basis. IBs will consist of de-ionized water and TRP LCSs will consist of 0.040 ppm PO₄-P standard. The TP digester will be assessed manually once monthly by the site operator through the introduction of a 0.060 ppm phosphoric acid standard. This frequency can be adjusted if it is determined that more frequent digester assessments are needed.

Once enough IB and LCS results are obtained, method performance criteria will be re-evaluated and adjusted if necessary.

Greenspan CS4-1200 Sonde

Please see Table A7.2 for QC criteria

An analytical SOP will be developed that detail sonde operation and quality control procedures.

Sonde DO, pH, and conductivity parameters are calibrated at a minimum once monthly. DO, SC, and pH Calibration Verification Samples (CVSs) are analyzed monthly.

Corrective Action Related to Quality Control

As described in Section B5 of the CWQMN QAPP.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

As described in CWQMN QAPP.

Aqualab TP Analyzer

Aqualab TP analyzer maintenance SOP will need to be developed. Greenspan analytical will be responsible for providing maintenance procedures to City of Waco/TCEQ.

The TP analyzer IB and LCS up-grades will be installed and tested after Analyzer deployment.

Greenspan Sonde

Greenspan Sonde maintenance SOP will need to be developed. TCEQ Austin Staff will provide sonde maintenance support.

Water Level Sensor

Please see In-Situ TROLL level sensor instruction manual.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Aqualab TP Analyzer

The analyzer automatically performs a three-point TRP calibration once daily.

Greenspan Sonde

The site operator will calibrate sonde parameters once monthly at a minimum.

Water Level Sensor

Water level sensor calibration frequency has not been determined.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

MOPs ambient monitoring section keeps an inventory of common spare parts. Parts can be sent via United Parcels Service and will usually arrive the next day (if mailed before noon on the mailing day). The Project lead will be responsible for the coordination of parts replacement.

Aqualab TP Analyzer

The Manager of Greenspan Analytical will be responsible for developing a spare parts list for common TP analyzer parts. When the parts list is developed MOPs will purchase and inventory TP analyzer parts.

TIAER will provide standard and reagents (including PO₄-P, phosphoric acid LCSs, MDL standards) under TCEQ contract. City of Waco will be responsible for obtaining standards and reagents from TIAER. TIAER does not commercially ship chemicals. **Note:** The Aqualab TP analyzer utilizes sulfuric acid reagents. TIAER will dispose of all extra standards and reagents.

Greenspan Sonde

Common Greenspan sonde spare parts are stocked by MOPs.

City of Waco will be responsible for obtaining pH calibration standards. Greenspan EC is calibrated by a calibration loop that will be supplied with the unit.

Water level Sensor

Water level sensors and communication cable are stocked by MOPs.

B9 NON-DIRECT MEASUREMENTS

There are no non-direct measurements used in this project.

B10 DATA MANAGEMENT

As described in CWQMN QAPP.

Project TRP, TP, DO, SC, pH, temperature and water level data will be stored in TCEQ's Leading Environmental Analysis and Display System (LEADS). The City of Waco will be responsible for obtaining and analyzing project data. LEADS training was provided City of Waco staff in February 2007.

C1 ASSESSMENTS AND RESPONSE ACTIONS

As described in CWQMN QAPP.

Corrective Action

As described in Section C1 of the CWQMN QAPP.

C2 REPORTS TO MANAGEMENT

As described in Section C2 of the CWQMN QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the CWQMN QAPP.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

Initially, TCEQ will be responsible for sonde and TP analyzer data validation.

Sonde

Sonde data validation is described in Section D1 of the CWQMN QAPP. Please see SOP DQRP-015, *Validation of Continuous Water Quality Monitoring Data Collected by Multi-parameter Sonde*.

TP Analyzer

Any Aqualab TP analyzer QC samples (IBs, and LCSs) that are outside the criteria listed in Table A7.1 back to the last analysis of QC samples that were not outside the operating limits, is qualified as invalid.

As described in Section D1 of the CWQMN QAPP.

D2 VERIFICATION AND VALIDATION METHODS

As described in Section D2 of the CWQMN QAPP.

D3 RECONCILIATION WITH USER REQUIREMENTS

As described in Section D3 of the CWQMN QAPP.